

**WHAT IS CLAIMED AS THE INVENTION IS:**

1. A method of obtaining sensory feedback from an electroactive polymer based transducer comprising the steps of:
  - 5 receiving a user input in a control system, combining it with a control system feedback signal from a sensory feedback circuitry and producing a control signal;  
receiving the control signal in an amplifier and sensory tone generator,  
combining it with an amplifier feedback signal from the sensory feedback circuitry and  
producing a power signal;
  - 10 receiving the power signal and an environmental disturbance in an electroactive polymer transducer and sensory circuitry and responsive to the user input producing a sensory signal;  
receiving the sensory signal in the sensory feedback circuitry and producing the control system feedback signal and the amplifier feedback signal; and producing a data  
15 output in the control system.
2. The method as claimed in claim 1 wherein the data output includes a strain-state of the electroactive polymer transducer.
- 20 3. The method as claimed in claim 2 wherein the strain-state is determined from the sensory signal.

4. The method as claimed in claim 1 wherein the data output includes a pressure-state of the electroactive polymer transducer.
5. The method as claimed in claim 4 wherein the pressure-state is determined from a  
5 combination of the sensory signal and a feedback of the power signal.
6. The method as claimed in claim 1 wherein the data output includes a health-state of the electroactive polymer transducer.
- 10 7. The method as claimed in claim 6 wherein the health-state is determined by monitoring a current in the transducer and determining if the current is above a predetermined level and if so the health of the transducer is compromised.
8. The method as claimed in claim 6 wherein the health-state is determined from a  
15 combination of the sensory signal and a feedback of the power signal.
9. The method as claimed in claim 1 wherein the data output includes a combination of a strain-state, a pressure-state, and a health-state of the electroactive polymer transducer.

20

10. The method as claimed in claim 9 wherein the combination of the strain-state, the pressure-state and the health-state is determined from a combination of the sensory signal and a feedback of the power signal.
- 5 11. The method as claimed in claim 1 wherein the electroactive polymer has electrical properties and the sensory signal measures the combined electrical properties of the electroactive polymer transducer and sensory circuitry.
12. The method as claimed in claim 1 wherein the sensory signal measures the  
10 capacitive property changes of the electroactive polymer transducer to infer a strain-state of the transducer.
13. The method as claimed in claim 1 wherein the sensory signal measures a resistive property changes of the electroactive polymer transducer to infer a strain-state of  
15 the transducer.
14. The method as claimed in claim 1 wherein the sensory signal measures a combination of a capacitive and resistive properties of the electroactive polymer transducer to infer a strain-state of the transducer.  
20
15. The method as claimed in claim 6 wherein the electroactive polymer transducer has electrical properties and the sensory signal is a low voltage , high frequency tone

used to measure the combined electrical properties of the electroactive polymer transducer and sensory circuitry.

16. The method as claimed in claim 1 wherein the sensory feedback circuitry comprises  
5 a means of extracting electrical property measurements of the electroactive polymer transducer from the sensory signal.

17. The method as claimed in claim 1 wherein the electroactive polymer transducer  
changes shape responsive to the power signal and the environmental disturbance.  
10

18. The method as claimed in claim 1 wherein the electroactive polymer transducer and  
sensory circuitry further produces a total signal.

19. The method as claimed in claim 1 wherein the electroactive polymer transducer and  
15 sensory circuitry further includes a protection circuitry.

20. The method as claimed in claim 1 wherein the user input is from a host computer.

21. The method as claimed in claim 1 wherein the user input is one of a position  
20 trajectory, a force trajectory, a combination position and force trajectory, a  
command to initiate completion of a pre-programmed trajectory and a command to  
confirm data output.

22. The method as claimed in claim 1 wherein the environmental disturbance is a mechanical load on the transducer.
- 5 23. The method as claimed in claim 1 wherein the amplifier and sensory tone generator includes a sensory tone generator, an amplifier and a pre-amplification stage and wherein the sensory tone generator produces a sensory tone, the control signal and the amplifier feedback signal are received by the pre-amplification stage to produce a complete signal, the complete signal and the sensory tone are  
10 received by the amplifier to produce the power signal.
24. The method as claimed in claim 23 wherein the amplifier and sensory tone generator further includes a protection circuitry.
- 15 25. The method as claimed in claim 24 wherein the pre-amplification stage acts as a power buffer for the control signal and the amplifier feedback signal.
26. The method as claimed in claim 23 wherein the sensory tone is a low voltage signal having an amplitude between 1mV and 10 V and a frequency between 1 Hz  
20 and 1 Mhz.

27. The method as claimed in claim 23 wherein the sensory tone generator includes one of a function generating circuitry, a pseudo-sine wave generating circuitry and a sine wave generating circuitry.
- 5 28. The method as claimed in claim 23 wherein the sensory tone signal has an amplitude between 500mV and 20V.
29. The method as claimed in claim 24 wherein the protection circuitry includes at least one of a series of nonlinear resistors, varistors and zener diodes and a  
10 combination thereof.
30. The method as claimed in claim 1 wherein the electroactive polymer transducer and sensory circuitry includes an electroactive polymer transducer, sensory circuitry and protection circuitry whereby the electroactive polymer transducer responds to  
15 the power signal and the environmental disturbance and changes the electrical properties thereof and wherein the amplitude of the sensory signal is responsive to the change in electrical properties of the electroactive polymer transducer.
31. The method as claimed in claim 30 wherein the control signal has a frequency  
20 spectrum and the sensory signal has a frequency spectrum which is greater than the frequency spectrum of the control signal.

32. The method as claimed in claim 1 wherein the sensory feedback circuitry includes a sensory signals preamplification stage, sensory signals extraction filters, voltage reduction circuitry, control signal preamplification stage, control signal extraction filters and rectification and sampling stage.

5

33. The method as claimed in claim 32 wherein an amplitude of the total signal is divided in the voltage reduction circuitry by a predetermined amount to produce a reduced total signal.

10 34. The method as claimed in claim 33 wherein the reduced total signal is buffered and amplified in the control signal preamplification stage and then passed to the control signal extraction filters wherein the recovered and conditioned control signal is extracted therefrom.

15 35. The method as claimed in claim 34 wherein the sensory signal is buffered and amplified in the sensory signals preamplification stage and then passed to the sensory signals extraction filters wherein the amplified and filtered sensory signal is produced.

20 36. The method as claimed in claim 35 wherein the rectification and sampling stage receives the amplified and filtered sensory signal and the recovered and

conditioned control signal and produces the control system feedback and the amplifier feedback.